Plastic Deformation of Foil Copper Crystals. II : Electron Microscopical Study

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Kôji SUMINO, Yôzô KAWASAKI, Mikio YAMAMOTO
and Masae P. SUMINO**

The Research Institute for Iron, Steel and Other Metals

Abstract

In order to study the relation between work-hardening characteristics of 10.0 and 50.8μ copper foil crystals and dislocation phenomena occurring in them, the distribution patterns of residual dislocations in the crystals have been observed as a function of strain, orientation, and specimen thickness.

Dislocation tangles were found at an early stage in the deformation of a specimen that showed the lowest value of the work-hardening rate. Tangles developing only along one kind of slip planes were observed in specimens showing low work-hardening rates. On the other hand, in specimens with high hardening rates, the development of cell structure is found without exception. The structures of the cell boundaries become more complex and, at the same time, the sizes of cells decrease as the strain increases. Configurations which are thought to show the formation of sessile dislocations, and pile-ups against them were also observed.

It is suggested that the cell structure is formed because of irregular and complex motions of dislocations determined by the complex internal stress field originating from dislocations accumulated during deformation.

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** Department of Applied Science, Faculty of Engineering, Tohoku University; now, at Chemistry Department, College of Arts and Science, Tohoku University.